DISCUSSION

It was previously noted that on Page 17, Lines 15 - 17 of the Specification in the present Application, it is stated:

> a sample supporting stage (STG) which can be translated in "X", "Y" or "Z" directions as well as rotated about "X", "Y" and optionally "Z" axes. (emphasis added)

The Examiner previously cited language in Xu et al. in Col. 5 Lines 55 - 60 states:

> Before the diffracting structure 112c is measured, an XYZ stage 14 is used for moving the wafer in the horizontal XY directions in order to first measure the film thickness and refractive index of the underlying structure underneath the photoresist pattern 12c. Stage 14 may also be used to adjust the z height of the wafer. (emphasis added)

And it was previously noted that nothing in that language, remotely suggests that the stage should allow rotation about X and/or Y axes. Only translation in XY directions is indicated in the cited references.

The Examiner has now cited language in the Background Section of Xu 656 which states that in 2-O Scatterometry systems:

> "By either rotating the sample or illuminating beam, the angle of incidence on the sample is changed."

and argued that this constitutes disclosure in Xu 656 of a system which comprises a rotatable stage.

I consulted Inventor Liphardt about this and he told me that the Xu language in the Background Section of Xu 656 which states that in 2-O Scatterometry systems:

> "By either rotating the sample or illuminating beam, the angle of incidence on the sample is changed."

is without any doubt what-so-ever a recital of a prior art approach to setting a plurality of angles-of-incidence (AOI) and not an indication that the stage in Xu is rotatable. He told me that one approach to Scatterometry uses one wavelength and a plurality of AOI's, which is what the Background Section language is describing. The Xu invention system, in 180 degree opposite sharp constrast, without any doubt fixes the Stage at a single AOI and applies a plurality of wavelengths. The Xu stage is fixed in place because any change in the AOI would unnecessarily greatly complicates the analysis of the data produced by the Xu system. The Inventor is aware of both approaches and confirms my statement that the Xu system does not include a rotatable stage. Further, the rotation of the Stage in the present invention is not for the purpose of enabling practice of scatterometry, but rather it has to do with the alignment of a sample on a stage.

Continuing, it is noted that said Xu Background language leads one reading it to conclude that a system for adjusting an angle-of-incidence of a beam of electromagentic radiation in a scatterometry system can follow either of two approaches, (ie. rotate the stae or beam). This is simply a recitation of a geometrically valid point. Nothing in said Xu Background language remotely hints that rotation of a stage should be selected and rotation of an illuminating beam rejected. And in that light, consistant with the Inventor's insight, it is again pointed out that nothing in the disclosure of the Xu 656

invention system describes it as having a rotatable stage. The Examiner now cites Fig. 1a in Xu for disclosure that the stage (14) therein is rotatable. However, Col. 5, Lines 55 - 60 of Xu 656 state:

> "Before the diffracting structure 12c is measured, an XYZ stage 14 is used for moving the wafer in the horizontal XY directions in order to first measure the film thickness and refractive index of the underlying structure underneath the photoresist pattern 12c. Stage 14 may also be used to adjust the z height of the wafer 12 as described below."

This says nothing about stage rotation. Further, the Examiner's attention is directed to the cited Fig. 1a in Xu. It is noted that it includes an indication of "X" "Y" "Z" translation in the lower right hand corner thereof, but includes absolutely no indication of rotation capability about said axes. Nothing in Fig. 1a would suggest providing the stage 14 with rotational capability. Further, Applicant maintains that nothing in the language of Xu 656 recited above which describes the system therein, or any other language in XU 656 which is directed to disclosing the invention system therein, remotely hints that the stage 14 therein should be rotatable. Instead, as stated, Xu 656 describes using the stage 14 to move a sample in translation so as to allow investigation of different positions of a sample. Again, Xu 656 is simply silent as regards rotating the stage 14 therein about "X" and "Y" axes. That being the case, nothing in Xu 656 can be read to suggest that the angle of incidence of a beam of electromagentic radiation to a sample should be adjusted via rotation of the stage rather than of the beam. Nothing in Xu 656 connects the general statement of fact in the Background Section regarding the existence of two approaches to adjusting an angle-of-incidence, to the Xu 656 system. Nothing in Xu 656 suggests that one skilled in the art select an approach to

changing an angle-of-incidence via rotating a stage. Again, Xu 656 is silent as to electing to rotate a stage in the system it describes. And that being the case, it is obvious that nothing in Xu 565 remotely suggests expanding rotation capability to additional dimensions. Nothing in Xu would lead one skilled in the art to seek out Ono or any other reference that describes a six degree of freedom stage. In that light, it is noted that the Examiner has further cited a Patent to Ono No. 6,259,174 to describe a stage which provides six degrees of freedom of movement. Applicant recognizes that Col. 13, Lines 16-20 as cited by the Examiner does disclose a stage with six degrees of freedom, however, the mechanism by which the stage is caused to move is magnetic. And even were Ono not directed to magentic means, the result would be the same. It is not the fact a multi-degree of freedom stage is present in the Present Invention that is important. What is important is that nothing in Xu guides the Examiner to add such capability to the Xu 656 system thereof.

In further response, the Examiner is reminded of the case Graham vs. John Deere Co. wherein it is made clear that it is improper to use prohibitied hindsight in the examination of Patent Applications. Specifically, the Examiner is not allowed to identify the elements in a new invention by reading the Specification of a Patent Application, then seek a plurality of prior art references which each contain various of the elements in somehow similar forms, then arbitrarily select certian somehow similar elements from one reference and other somehow smilar elements from other references, while rejecting other elements which are present in said plurlaity of other references, and then modify the chosen elements and combine the chosen somehow similar elements into a new invention, UNLESS, ONE SAID PRIOR ART REFERENCE PROVIDES INSTRUCTIONS FOR SO DOING. Applicant argues that the Examiner has demonstrated just such an approach to

Examination of the present Application, and has found the Ono 174 Patent only by noting a need for a reference to provide rotational capability about "X" and "Y" axes which is the Examiner agrees is not disclosed in Xu 656, and then seeking a reference that provided the missing teachings. Nothing in Xu 656 fairly can be seen to suggest that an inventor seek out a stage which is rotatable about "X" and "Y" axes. There is simply no hint that the stage 14 described in the Xu 656 system be other than a translation providing means. Therefore, the only reason to seek out Ono 174, in view of Xu 656 is that the Examiner needed a reference that provided a stage with such rotational capability. The Examiner can be expected to argue that the general statement in the Background Section of Xu 656 to the effect that a stage can be rotatable provides the needed link, but, as pointed out above, nothing in said Xu 656 Background Section remotely suggests that stage rotation should be elected over beam rotation as an approach to adjusting angle-of-incidence. Only the present Application provides insight to the fact that such an election was made in the present invention approach. And only the present Specification describes expanding the stage degrees of freedom to six. Again, the Examiner can not note that said election was made in the present invention system and read it into Xu 656 after the fact because a deficinecy in Xu exists and then somehow identify Ono to fill the void. The link between Xu 656 and Ono 174 can fairly only be found in the Present Application, and the Examiner can not use it to provide said link. Doing so is direct evidence to an approach to Examination based in prohibited hindsight. Again, the Examiner is not allowed to note the elements in a New Invention by a reading of the Specification of a Patent Application, and then seek out a plurality of references that in combination present somehow similar elements, and, while arbitrarily rejecting other elements present in said plurality of references, modify and combine the identified elements to arrive at the New invention.

There must be instructions in ONE reference to guide said efforts, and said guidance is simply not found in Xu.

It is also noted in passing that the areas of art to which Xu 656 and Ono 174 belong are very different. One skilled in the art of aligning samples in both tip and tilt by rotating a stage about "X" and "Y" axes to would be unlikely to be aware of said references. Further, being aware of one would not fairly lead to finding the other without knowledge of the elements which make-up the new invention.

To summarize the foregoing, it is believed it is clear that the simple statement of a fact in the Background Section of Xu 656 to the effect that either a stage or beam can be rotated in a scatterometry system to set an angle-of-incidence therebetween is not remotely a basis for an inventor to elect the approach of rotating a stage to do so and reject the approach of rotating a beam in a system for aligneing a sample, and said simple statement does not in any way imply that the Xu 656 system should include a stage which can be rotated about "X" and "Y" axes. Nothing in the description of the Xu 656 system or the Drawings in Xu 656 remotely hints at such. It is believed also clear that nothing in the description of the Xu 656 system would lead one skilled in the art to seek out Ono 174. The conclusion is that the Examiner has simply noted what elements are present in the present invention, and then sought out prior art in which somehow similar elements are present, and then applied teachings in the present Application to guide their modification, (while rejecting other elements present in said prior art), and combination to arrive at the present invention. There simply is no other logical explanation for the identification of Ono as there are no instructions in Xu which would lead one skilled in the art to seek a stage with 6 degrees of freedom. The only

relevant statement in Xu 656 is in its Background Section and constitutes nothing but a general recitation of a fact that there are two approaches to setting an angle-of-incidence in a scatterometry system. Said statement does not provide any indication of which should be chosen by a new inventor or that if one is chosen, then not only should a stage be rotatable to set an angle-of-incidence, but also to set a plane-of-incidence by providing additional degrees of freedom. No teachings in a SINGLE PRIOR ART REFERENCE provide the necessary instructions for one skilled in the art to follow to arrive at the present invnetion, OTHER THAN THE PRESENT APPLICATION SPECIFICATION, and its use is prohibited under the Graham case.

It is also noted that Col. 9, Lines 46 - 55 indicate that the angle-of-incidence utilized in Xu 656 can vary between 40 to 80 degrees. This is extemely good evidence that it is the beam that would be rotated in Xu, if any rotation is done at all, which is not evident in XU, as if the stage were rotated it would be necessary to greatly change the position of the Spectrometer Reflectometer 60 as well as the SE spectrometer 34. This would be a huge nuisance to a researcher. Its one thing to change both the Illuminator 26 and SE spectrometer 34 through 40 degrees, but if the sample is rotated to change the angle-of-incidence through 40 degrees, the SE spectrometer would have to be rotated through 80 degrees to receive an oblique angle reflected beam, and the Spectrometer Reflectometer 60 would have to be rotated through 40 degrees. It would make no sense to do all that in view of all the alignment that would accompany the practice. This is good practical evidence that XU elected to rotate the beam and not the stage, when selecting between the two possibilities mentioned in the Background Section thereof. Therefore, the Xu teachings would have to be, in a rational practical sense, that for the Xu

system, rotating the stage is not elected, thus teaching away from the presence of a rotatable stage---just as shown by the Xu Drawings and stated everywhere in Xu 656 other than the mention of rotating a stage in passing in the Background Section with ressepct to scatterometry.

Continuing, the Xu 656 Patent provides that a Spectroscopic Reflectometer 60 be present. See Xu 656 Fig. 1 and Col. 6, Lines 39 - 41. Nothing in Xu 656 suggests its removal, as a large pecentage of the system's capability would be lost if it were, yet there is nothing in the present invention which is its equivalent. The closest is perhaps CCD2 in Fig. 4. However, said CCD2 is a Camera, (see Page 18, Lines 25 - 35 of the Present Specification), which provides an impage to Display Means (M2). Said CCD2 is not a Xu 656 Spectroscopic Reflectometer 60. Further, Xu 656 includes a block 64 for conducting "pattern recognition". Again, nothing in Xu 656 suggests its removal, yet there is nothing equivalent to it in the present invention. Perhaps the closest is the CCD1 and M1 in combination in the present invention system, which enable viewing the surface of a sample using light from LEDS which are present beneath the Beam Spliter (BS1). Nothing in Xu 656 instructs removing the Spectroscopic Reflectometer 60 or modifying it to be a means for aligning the sample as are CCD2 and M2 in present in the present invention, or removing the pattern recognition block or modifying it to be a CCD1 and M1 for viewing the surface of a sample. Nothing in Xu 6556 provides such guidance because the purpose of the Xu 656 system would not be served thereby. Simply, the Xu system is designed for very different purposes than is the present invention system.

Turning now to specific cited langauge regarding Claim 1.

As regards Claim 1 the Examiner cites XU 656 as disclosing a

system "comprising a pivot mounted stage/sample (14)" (Fig. 1a)." As shown in the foregoing, the Xu 656 Fig. 1a stage (14) does not show a rotatable stage. If rotation were allowed the Fig. 1a should indicate such along with the "X" "Y" "Z" translation indication. Applicant agrees that stage (14) in Xu 656 does show translation capability in the "Z" direction.

The Examiner identifies element (22) in XU 656 as a "first source" of a first beam of electromagentic radiation. On its own this is a reasonable assertion as in Col. 6 Line Line 20 Xu 656 does refer to the element (22) as "the radiation source". However, the Examiner then continues to refer to a "second source" of a beam of electromagnetic radiation (30), without identifing said second source in XU 656. This is because there is no second source in Xu 656. The beam (30) is not a source, it is a beam, and it is provided by said "first" and only source (22). In contrast, the present Application identifies Two (2) Sources, namely (PSG) which provides beam (EI), and (BBS) which is the source of beam (IB).

The Examiner identifies Claim 1 language regarding:

> a first source of a first beam of electromagnetic radiation in functional combination with a multi-element alignment detector comprised of at least two detector elements surrounding a hole therethrough;

and cites Xu 34/60 as the detector elements. Applicant does not at all understand this. The Xu 34/60 are two seperate DATA detectors, not a detector comprised of at least two detector elements surrounding a hole therethrough, and furthermore,

neither is an alignment detector as shown in Fig. 3b of the present Application. There are no Alignment Detectors in the Xu 656 Patent, as that terminology is used in the Present Application! In particular, the Xu detector 34 is a Spectroscopic Ellipsometer SE Spectrometer and the Xu element 60 is a Spectro-Reflectometer. Each of the 34 and 60 Detectors produces a signal corresponding to whatever electromagnetic radiation is entered thereinto and provides Ellipsometric or Intensity information about the sample being investigated. It is noted at this point that the Xu 656 SE Spectrometer 34 corresponds to the (PSD) in Fig. 4 of the present Application and the Xu Spectro-Reflecometer 60 has no counterpart in the present Invention System.

Continuing, in contrast to the Xu 656 system, and as best shown in Fig. 3a of the Present Application, a First Beam (EM1) of electromagnetic radiation is shown as being produed by a First Source (S1), then proceeding through a hole (see (ME) in Fig. 3b, between Detector Elements (D1) (D2) (D3) and (D4)). In Fig. 3a Detector Element (D3) is also shown behind the Beam (EM1). Also, a Second Beam (EM2) is shown as produced by Second Source (S2) and it proceeds as recited in Claim 1:

> said second source of electromagnetic radiation being positioned to provide a second beam of electromagnetic radiation and direct it to the surface of said sample at an oblique angle thereto, such that said second beam of electromagnetic radiation reflects from said surface of said pivot mounted stage/sample;

It should be apparent that tilt/tip of the stage in Fig. 3a causes the Detector elements (D1) (D2) and (D3) (and D4 in Fig. 3b), to receive differing amounts of a reflected (EM1) beam, and that by causing tilt/tip of the Sample (as represented as

supported by a Pivot (P) which would allow such tip/tilt), while monitoring the outputs of the Detector elements (D1) (D2) (D3) and (D4), a tip/tilt which provides the reflected (EM1) along the locus of the incident (EM1) can be achieved and thus alignment of the Sample accomplished. It is not at all understood how the Data Detectors 34 and 60 of Xu 656 could remotely be so applied.

For emphasis, again, there is no Second Source of electromagnetic radiation in Xu 656. There is only the single Source (22) in Xu 656 which provides electromagnetic radiation both normal and at an oblique angle to the sample via Beam Splitter 52 and the Illuminator 26, respectively. And also again for emphasis, there is no Alignment Detector in Xu 656, only data detectors 34 and 60, one of which, 34, corresponds to the Polarization State Detector (PSD) of the Present Invention system, and one of which, 60, has no equivlent in the Present Invention.

To emphasise the difference between the Alignment Detector of the Present Invention and the Data Detectors 34 and 60 in Xu 656, Claims 1 and 2 herein are further Amended over that previously submitted, (which previous Amendments are entered to Cklaims 1 and 2 herein), to provide recitation that said Detector Elements closely surrounding a Hole in the Alignment Detector. It is believed that this avoids the Examiner's position that Xu 656 Detectors 34 and 60 are two detector elements surrounding a hole.

As presented in an earlier Response, again further note that Figs. 3a, 3b, 3c and 3d of the Present Application indicate that such a rotation about XY axes is possible in the present invention. Figs. 3a - 3c show a pivot mounting centrally contacting the Sample from below which allows such rotation about X and/or Y axes. And Fig. 3d shows an exemplary Stage which has

corner mounted screws (P). The screws can be variously operated to effectively cause the Stage to tilt about X and Y axes. Further, nothing in any cited reference suggests, as, for example, recited in Claims 2 and 7 of the present Application as amended herein for clarity, that a method step should involve:

> c) pivoting said sample about said stage/sample pivot mounting about at least one of the "X" and "Y" axes until signals from all of the detector detector elements in the multi-element alignment detector are substantially minimized or equalized, indicating that said first beam of electromagnetic radiation approaches said surface of said sample substantially along a normal thereto;

The present Application provides for Pivoting about X and/or Y axes to align the surface of a sample so that a normal thereto projects at a known angle, thereby providing known relationship between the locus of the first and second beams, whereas the cited art provides for XY translational motion only. And again, the Examiner identifed the generic language in the Background of Xu 656 in Col 2, Lines 1-2 is not descriptive of the Xu 656 invention system, but rather a general statement of fact. An angle of incidence can be adjusted by rotating a beam or a stage. But stage rotation is not described in any disclosure of the Xu 656 system.

In summary, the only mention of stage rotation in Xu 656 is in the Background Section thereof, and nothing in the disclosure of the Xu system per se. remotely hints that the stage in said Patent should be rotatable. The link in Xu to the identification of Ono 174 is thus believed to be non-existant and the Examiner's identification of Ono 174 therefore in violation of prohibition of the use of Hindsight as recited in the Graham vs. John Deere

Co. criteria. Further, Ono 174 describes use of magnetic stage motion causing means and it is pointed out that there are no Alignment Detectors in Xu 656. The Examiner's identification of Xu 656 Detectors 34 and 60 as being Alignment Detectors therefore is believed to be an error. To avoid the last two points Applicant has Amended Claims 1 and 2 of the Present Invention to recite use of mechanical tip/tilt causing means and to clarify that the Present Invention Alignment Detector having a Hole therein comprise a multi-element alignment detector comprised of at least two detector elements closely surrounding a hole therethrough. Even if the Examiner's position that Xu Detectors 34 and 60 are Alignment Detectors, (which they are not), it must be conceded that said Detectors 34 and 60 do not comprise a, (not multiple separate), multi-element alignment, (not data), detector comprised of at least two detector elements closely surrounding a hole therethrough. And as for Claim 4, wherein the multi-element alignment detector does not necessarily have a Hole therethrough, it is pointed out that said Alignment Detector receives electromagentic radiation via a Beam Splitter. The only Beam Splitter in Xu 656 is element 52, which, as decribed above mediates electromagnetic radiation into detector 60, which is not an Alignment Detector, but rather a Spectroreflectometer Data Detector. Further, there is only One Source of electromganetic radiation disclosed in Xu 656, (eg. the element identified by 22), and the present invention system clearly identifies the presence of Two (2) Sources (eg. BBS and PSG) in Fig. 4 thereof. Nothing in Xu remotely suggests that a second Source should be present, and that it be a Polarization State Generator (PSG). Claims 1, 2, 6 and 7 are also Amended herein to make clear that the Second Source is a (PSG).

It is believed that in combination, the points presented above along with Amendments to Claims 1, 2, 6 and 7 distinguish the Present Invention, as Claimed, over the cited existing art.

It is now believed that Claims 1-18 are in order for Allowance, and therefore the Examiner is respectfully requested to provide the Notice of Allowance and Issue Fee due. Should problems remain please contact Attorney Welch who is receptive to Examiner Suggestion and Amendment.

Sincerely,

JAMES D. WELCH
JW/ns
enc.